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A study of *Quercus Leana*.¹

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The oak known as *Quercus Leana* Nutt. is considered a hybrid of the shingle oak, *Q. imbricaria* Mx., and the scarlet oak, *Q. coccinea* Wang., the latter including the black oak, *Q. tinctoria* Bartram, as a variety. It has been sparingly found in the central states, and also near Washington in the east. The original tree, figured and described by Nuttall in his continuation of Michaux's *Silva*,² was detected about fifty years ago by T. G. Lea, near Cincinnati, O. Since then it has been found in several places in Illinois and Missouri by Dr. Mead, Dr. Engelmann, and others. In most of these localities but a single tree, or a couple of trees, were seen.³ Some of these have since been destroyed. Like other hybrid oaks it is very rare, though more frequent perhaps than has been reported, since it is easily overlooked unless one is familiar with the varied characters of some of the biennial-fruited oaks, particularly the species with lobed leaves.

In the summer of 1890 I came across a form of this hybrid in greater numbers than have been reported elsewhere, and have observed them each season since. The locality is near Willow Springs, about fifteen miles southwest of Chicago. Eight or ten pretty clear cases of hybridity were at first made out, and some others noticed which seemed to show the effects of crossing, but were not distinct enough to be satisfactorily separated from the typical *Q. imbricaria*. Most of these trees have since been cut down, and last year but one remained, though stool shoots were starting from the stumps of some

¹Forming part of a paper on "Natural Hybrids" read before the Chicago Academy of Sciences.

²l. c. 1: pl. 5 bis.

³Engelmann, Papers on American Oaks. Botanical Works, 405.

that had been removed, showing that the roots readily produce a coppice. Attention was first called to these trees by finding twigs torn off and scattered over the ground by a heavy storm of wind. Among them were some carrying leaves of an unfamiliar kind of oak, which were soon traced to the trees from which they came. The trees were mixed with others, mostly oaks represented in the hybrid, within an area of a couple of acres. The soil was of a gravelly nature, almost exclusively bearing oaks and hickories, with an undergrowth of hazel in the more open spaces. The hybrid trees were from fifty to sixty feet high, their bolls free from limbs for the first fifteen or twenty feet, except from the occasional presence of adventitious shoots. The largest tree was three feet nine inches in circumference at a foot and a half above the surface of the ground, just beyond the swelling occasioned by the roots. The rest were about a foot in diameter, so nearly of the same girth and height as to indicate that they were of about the same age. The outer bark could not be distinguished from that of the typical shingle oak of the same age and size, being but slightly furrowed, close and rather smooth, and of a dark gray color. The trunks did not have the black, rough and deeply furrowed bark so characteristic of the black oak even on small trees, for it begins to have this character quite early in life. A section of the bark showed essentially the same characteristics as that of the shingle oak, the inner bark being of a reddish or reddish-yellow color.

The leaves are from three to seven inches long, and one third as wide, on peduncles about an inch in length. They are somewhat pointed, and with a variable base, either acute, wedge-shaped, or rounded, sometimes approaching a cordate form, the broader leaves usually with a rounder or fuller base. The margin varies from forms slightly undulate to those irregularly sinuate-lobed to coarsely dentate-lobed. When lobed the segments are either rounded or acute, and when acute are triangular in form. The sharp lobes end in a bristle, and the adjoining sinuses are deeper and narrower than those in leaves with rounded lobes. In this lobation the influence of the black oak is seen, changing the form of leaves with an entire margin, characteristic of the shingle oak, to those approaching the less divided kinds of the black oak. The leaves on the stool shoots are larger, and are less divided than

those on the trees. This is apt to be the case in the young growth of all the oaks. The lobes are acute, or blunt, most of them tipped with a bristle. Some leaves are pointed as on the trees, and others are broader at the apex, ending in three lobes, resembling those figured by Dr. Brendel from a hybrid oak, *Q. Leana*, near Peoria, Ill.⁴ The leaves on the upper part of the trees showed a tendency to a deeper lobation than those on the lower limbs, especially than those on adventitious shoots of the trunk. The leaf surface is glossy, having about the same luster and color as that of the black and the scarlet oaks, but paler than in the shingle oak. In the mature leaves there is a trace of pubescence along the midrib and primary veins beneath. Young leaves, as well as those of the stool-shoots, are more or less rusty-pubescent, especially on the lower surface, about as much so as in *Q. imbricaria*. The margin of the leaves, particularly when young, is a little revolute, showing in this as well as in the pubescence the effects of the shingle oak. The winter buds are ovate, blunt three-to five-angled, larger than those of *Q. imbricaria*, but not so large or rusty-downy as those of *Q. tinctoria*. The hairs on the freshly started leaves are identical in structure with those of *Q. imbricaria*, being dense, matted, and curled or woolly, while those of the black and scarlet oaks are longer, coarser, straighter and scarcely matted. The bark of the young branches is greyish-brown, with numerous roundish gray and often warty lenticels raised above the surface. The color of the bark is like that of *Q. imbricaria*, but the lenticels are more prominent.

The perianth of the male flower is hairy, two- to four-parted, with thin, yellowish-brown segments; the stamens are four to five with large blunt anthers, on smooth filaments one-third to one-half their length. The acorns are roundish-ovate, half an inch long, with a short blunt or truncated knob at the top. The cup is saucer-shaped, covering about one-third of the nut; the scales of the cup are pubescent, blunt and appressed, occasionally a little squarrose near the margin of the cup. The acorns, especially when fresh, are often longitudinally striped with bands of a darker color, as in many of the black-oaks. They are somewhat larger than those of the shingle-oak, with a more prominent knob, that of the latter being but slightly raised or often quite flat or nearly obsolete, with a

⁴The American Entomologist and Botanist, 2: 316. 1870.

flat areola at its base. In the black and the scarlet oak the knob is prominent, and more pointed and conical. The acorn-cup is flattish and abruptly contracted to the short peduncle as it is in the shingle oak, while in the black and the scarlet oaks it is more rounded and tapering below, sometimes in the scarlet oak being quite conical beneath. The acorns of nearly all specimens of *Q. tinctoria* growing in the vicinity of the hybrid were, so far as examined, considerably larger than those of the hybrid. Their cup-scales were very pubescent, and almost always with wavy, squarrose tips. The meat of the acorns was intensely bitter, from a light to a deep yellow or orange color, not white or pale as is generally the case with the scarlet oak. The interior of the cup was yellow. The meat of the acorns of the hybrid was of a pale yellow color and was very bitter in taste. By the character of the fruit, the color of the outer bark and the rich yellowish-brown or russet tinge of the autumn leaves, the neighboring biennial-fruited oaks had the characteristics of *Q. tinctoria*. But the leaves were usually deeply lobed, and the inner bark, though generally yellow, was sometimes reddish as in the scarlet oak. From all indications, the hybrid seemed to be a cross of *Q. tinctoria* and *Q. imbricaria*. But the characteristics of *Q. tinctoria* and *Q. coccinea* sometimes blend so far as to make it difficult to separate them, though from careful study of the various forms I believe them to be distinct. If, as many do, we regard *Q. tinctoria* of Bartram a variety of *Q. coccinea* of Wangenheim, then the hybrids at Willow Spings would be a cross derived from the variety, not the type.

Quercus rubra occurred not far away in the same piece of woods, but no signs of hybridism were seen between the red oak and the shingle oaks in its vicinity. These were not scattered throughout the woods, but were frequent only where the hybrids were found. Two annual-fruited species, *Q. alba* and *Q. macrocarpa*, were the only other kinds observed, but such seem out of the question for parentage.

The hybrids differed somewhat from the published descriptions of *Q. Leana* which I have seen, combining most of the characteristics of the individual cases described from other localities. The number of trees offered a greater range for showing the influence of the double parentage. But it was quite easy to match the leaves with those which I examined in the large collection of the Engelmann herbarium, now in

the Missouri Botanic Garden at St. Louis. They do not differ materially from authenticated specimens from the original tree at Cincinnati, nor from those figured by Nuttall. As Dr. Engelmann did not specifically separate *Q. tinctoria* from *Q. coccinea*, there is no way to determine which of the two he regarded as most effective on the hybrid. He says of the hybrid: "The relationship to *imbricaria* is unquestionable, and among the lobed-leaved black oaks we must look to one of the forms of *coccinea* for the other parent, as the acorns, and especially the cup and scales, indicate." Of one growing in St. Clair county, Ill., twenty miles from St. Louis, and of which *Q. rubra* was at first thought to be one of the parents, he says: "The cup of the acorn is to me decisive. It is turbinate, covered with rather large canescent scales, squarrose at the tip, and very different from either *rubra* or *imbricaria*, but approaching those of *coccinea*. The globose acorn, seven lines in diameter, one-third covered by the cup, shows twenty-two to twenty-five black stripes, so common in many black-oaks."⁵

No seedlings of the hybrid were detected. Those of any of the oaks were scarce, since the wood was a pasture for horses and cattle, though not so closely pastured as to prevent a considerable undergrowth of shrubs. But it is probable that the hybrids, or some of them, considering their number, came from acorns. There is no apparent defect in the nuts, which are as plump and are produced as abundantly as those of other oaks in the vicinity. Dr. Engelmann has also noticed the scarcity of seedlings of hybrid oaks, and remarks upon it: "All of the supposed hybrids are abundantly fertile, and those of their acorns which have been tested have well germinated; in fact, as far as I know, no difference in fertility between them and the acknowledged species has been discovered. The seedlings of such questionable individuals do not seem to revert to a supposed parent, but 'come true,' as the nurserymen express it. For how many generations this may continue, and whether in time forms approaching one or the other parent may not appear, remains to be seen. At the same time it is a remarkable fact, that notwithstanding their fertility they do not seem to propagate in their natural woods. We may, perhaps, ascribe this to a lesser degree of vitality in the hybrid progeny which causes them to be crowded

⁵Botanical Works, 406.

out in the struggle for existence; one of the provisions of nature to keep the species distinct; or, as Dr. Gray suggests, fertilization by one of the parents may soon extinguish the hybrid characters."⁶

To those who question the hybridity of these oaks, and deem such forms varieties of closely related but very variable species, the answer may be made that, since hybridizing is a frequent resort of the horticulturist for the production of new varieties of plants, it is to be expected that something of the same kind will occur in nature where plants nearly related grow together promiscuously. As such crosses are effected by dusting the stigma of one species or variety with the pollen of another species or variety of the same genus, or in the case of bigeneric hybrids, of a different genus, similar results may be looked for among wild plants where this dusting must often occur whether effective or not. But it is in the highest degree efficient for plants of the same species to be cross-fertilized, and in many cases it is the sole method of fertility. It is done on so large a scale by various agencies that our surprise should not be at finding spontaneous hybrids, but that they are seemingly so rare in wild plants. Failure to produce them has to be ascribed to other causes than the lack of opportunity. And it is in genera with dicæcious, and often anemophilous, flowers, such as *Carex*, *Quercus* and *Salix*, that hybrids have most frequently been detected in nature. Especially is this the case with willows.⁷ With such genera the conditions are least complex, and the opportunities for hybridizing most frequent.

These oaks plainly show the marks of hybridism such as have been noted by various observers, and summarized by Sachs, among which the two following closely apply: (a) "The hybrid is possessed of external characters intermediate between those of its parent forms, usually nearly half way between. (b) The characteristics of the parent-forms are as a rule so transmitted to the hybrid that the influence of both is manifested in all its characters, producing a fusion of the different peculiarities."⁸

It is also very strongly in favor of their hybridity for these

⁶Botanical Works, 403.

⁷Insects, especially bees, take an active part in the pollination of willows. Wimmer, *Salices Europaeae*, Introduction, p. *xlviii*. *Ib.* *Wildwachsende Bastardpflanzen*, 144.

⁸Lehrbuch (4th ed.) 891. Text Book, 917.

oaks to occur only where the shingle oak is found. Having frequently and extensively traversed the woodlands in the vicinity of Chicago, and carefully examined the oaks of different localities, since they are the prevailing trees, I have only seen this form where we first meet with the shingle oak, which comes up the valley of the Desplaines as far north as Willow Springs, at least. It is on the border of the northern limits of the species in this vicinity, for it becomes a common tree only to the south. Immediately east and south in the sandy region by the head of Lake Michigan the black oak is the prevailing species, probably ten times as numerous as the other biennial-fruited oaks taken together. But leaves of the peculiar form shown by the hybrid have been detected nowhere else. There are plenty of transitions in leaf-forms between the black and the scarlet oak, and to some extent between these and the red oak, but none between them and the shingle oak except where *Q. imbricaria* was first encountered, for both the species and the hybrid were found the first time of visiting the locality. Though the proof from proximity may not be conclusive, when it is taken in connection with the blended characteristics of the form, it is hard to resist the conviction that the parentage was specifically double, and that the parent-forms are those whose characters are most evident in the offspring.

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